FRD Activities Report
October 2002

Research Programs

Hurricane Balloon

In late October, as Hurricane Kenna approached the west coast of Mexico, a newly developed FRD hurricane balloon was launched from a weather station in Mazatlan, Mexico. This launch was our first attempt to insert a balloon into an actual hurricane. The hurricane balloon was launched shortly after midnight on October 25, 2002 from a Mexican government weather observatory and balloon launch facility in the west coast city of Mazatlan. The balloon was launched at 12:27 a.m. local time and headed in a SSE direction at an average speed of about 4.9 m s^{-1} (Figure 1). Communication with the balloon and data acquisition was maintained through an onboard satellite telephone. While the balloon was ascending through the 300 to 700 m altitude, it experienced horizontal speeds of about 8.7 m s^{-1}. The balloon was ballasted to rise to 600 to 700 m ASL with 500 m of extra lift added in anticipation of precipitation that had been experienced during inflation and ballasting. No precipitation was encountered, however, and the balloon rose to 1196 m ASL within 15 minutes after launch (Figure 2). Since this altitude was higher than the configured window of operation, the ballast pump turned on and started pumping. Over a period of 23 minutes the balloon altitude decreased about 164 m to 1032 m ASL.

Figure 1. Track of the hurricane balloon launched from Mazatlan for insertion into Hurricane Kenna. Landing occurred northwest of Mazatlan 1 hour 20 minutes later.

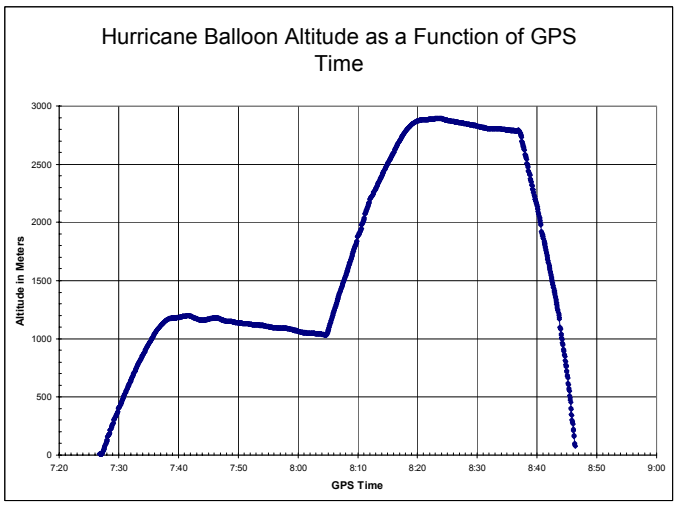

Figure 2. Hurricane balloon altitude during flight.

About 38 minutes after balloon launch, the balloon altitude suddenly began increasing while the internal pressure of the balloon decreased to zero in less than one minute. It quickly became apparent that we had experienced a failure of the outer or ballast bladder, thus causing the sudden increase in altitude. In 19 minutes the balloon altitude increased from 1032 m to 2893 m. At the higher altitude the balloon direction changed by about 180 degrees and headed back toward the launch site in Mazatlan. One hour and 10 minutes after launching the balloon, when it had become obvious that the balloon was not going to make it into the center of Hurricane Kenna, the computerized command was sent to bring the balloon down. This command opened a 10 cm diameter valve in the top of the balloon to quickly release the helium and start the balloon descent. Ten minutes after the helium release valve was opened, the balloon landed about 6 km northwest of the launch facility. The average descent rate was 4.7 m s^{-1} and the maximum descent rate as the balloon approached the ground was about 8.3 m s^{-1}.

Although the balloon was unable to make it into Hurricane Kenna, we were able to accomplish a great deal with our first attempted launch into a hurricane. For example:

- We were able to quickly obtain Mexican government permission to go to a alternate launch site that better suited the trajectory of hurricane Kenna.

- With less than a day's notice, we were able to make all of the travel arrangements and, with all of our balloons and launch equipment, travel to Mazatlan, Mexico.

- With help from the Mexican personnel at the Mazatlan weather station, we were able to successfully procure the necessary helium to inflate and launch the balloon.

- We had what appeared to be a good forecast and timing on the balloon launch trajectory to intercept hurricane Kenna.

- We were able to track and control the balloon continuously during flight all the way from launch to bringing the balloon down successfully.

With the experience we gained on this deployment, we are better prepared for any future launch. (Randy.Johnson@noaa.inel.gov, Shane Beard, Tom Strong, Roger Carter)

Joint URBAN 2003

Planning for the July 2003 field deployment to Oklahoma City, Oklahoma, continued during the month of October. A decision was made by the science committee to fund the construction of an additional 50 programmable integrated gas samplers (PIGS). Research and development of a new generation bag sampler dubbed PIGS-II is proceeding (see related article.) The chairman of the science committee briefed the Oklahoma City mayor and city council and received their endorsement to conduct the experiment in their city. In conjunction with that presentation, potential sodar sites were selected and permissions from building owners and managers were secured for placement of real-time samplers and PIGS. Building managers were very friendly and helpful, even giving permission to place samplers on roofs and on external fire exit

stairways. This will provide a unique and here-to-fore unused opportunity for vertical sampling of an intentionally released atmospheric tracer. (Kirk.Clawson@noaa.gov, Jerry Crescenti, and staff)

New Programmable Integrating Gas Sampler (PIGS-II)

We have completed the construction of a prototype "next generation bag sampler" in preparation for deployment during the Joint URBAN 2003 experiment. It incorporates a new sampler design philosophy whereby the sampler is placed inside a cartridge containing sample bags, rather than placing the cartridge inside a sampler, as is the mode of operation of our currently used samplers (Figures 3 and 4). A DOS Stamp microcontroller has been interfaced with a pump, valves, interface circuitry, and sensors for this new sampler. A prototyping test program has been developed to help test the operation of the new pump control logic and the operation and reliability of the electronics.

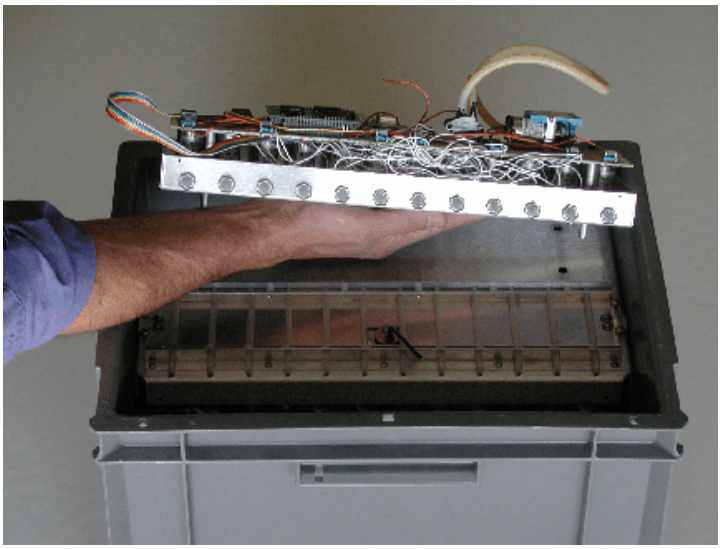

Figure 3. Prototype programmable integrating gas sampler showing the sampler module containing the pump and circuitry (top of photo) and the cartridge containing the sample bags together with the interlocking mechanism.

Our present generation samplers have no feedback on the pump flow rate and rely on uniformity between the 12 different pumps. The bags are filled based on an estimate of how many pump cycles will be needed to fill each of the 12 bags in the sampler at the ambient temperature during the time the sampler is to operate. This system has worked successfully most of the time in past field experiments. However, by designing the new sampler with 12 miniature valves, a single pump, and a means for metering the pump flow to each bag, we can build a less expensive sampler with much better control of the sample volume in each bag. We also hope to decrease and hopefully eliminate field

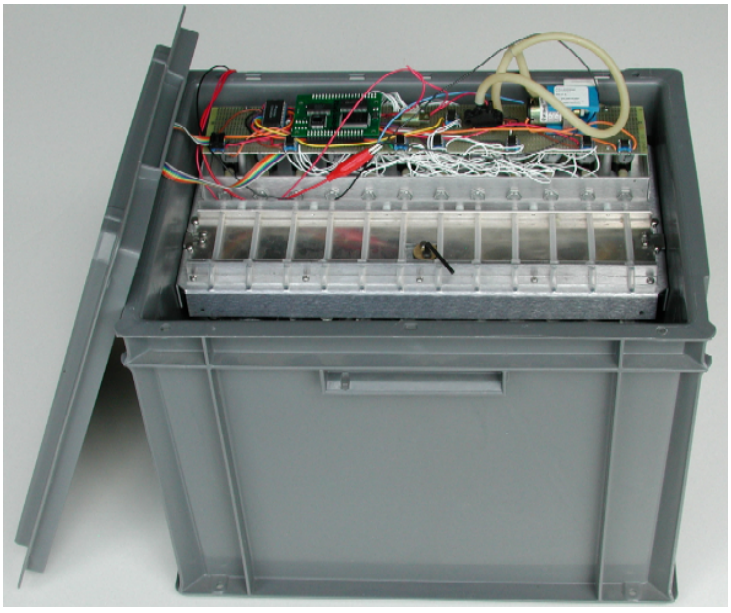

Figure 4. Prototype programmable integrating gas sampler showing the sampler module installed in the sample cartridge.

operator errors with a newly designed sampler-to-cartridge mechanical interface and interlock. The interlock incorporates a bag tube closing mechanism that opens and closes each tube simultaneously with the flick of the operator's wrist. An additional 65 new generation samplers will be added to the existing inventory of 140 samplers to give us the quantity of samplers required for the Joint Urban 2003 experiment. (Randy.Johnson@noaa.gov, Roger Carter, Shane Beard)

Perlan Project

Funding was awarded for a joint NASA/NOAA project to measure turbulence and investigate stratospheric gravity waves as part of the NASA-supported Perlan project. The Perlan project is an ongoing effort, begun in 2001, to use a specially designed sailplane to soar to 100,000 ft within upward propagating stratospheric mountain waves (http://www.firnspiegel.com/perlan). In the first phase of the NASA/NOAA joint effort, we will build and mount a BAT probe on the sailplane and consult with NASA scientists and engineers to design and build a data system capable of operating under extreme conditions (very low pressure, temperatures to -65 C). Initial flight tests are scheduled for February of 2003 in the lee of the Sierra Mountains in California. A second deployment is scheduled for June/July of 2003 in New Zealand. (Jeff.French@noaa.gov, Randy Johnson)

CLAST-High

The newly developed FRD aluminum version of the BAT probe is now mounted on one of the NOAA P3's and is awaiting flight testing. The aluminum BAT probe face was developed to overcome the pitting problems encountered on a carbon fiber probe face during flight in heavy precipitation. We expect a flight test to be conducted in mid-November, with more extensive testing in December and early January, before the BAT is returned to FRD in mid-winter.

Work continues on data processing from the three flights during which data was collected from the NOAA P3 BAT probe system earlier this year. Preliminary results are promising and indicate that the equipment was operating properly. Analysis still needs to be conducted to verify the frequency response of the instruments to determine how vibration on the nose boom affected our measurements. (Jeff.French@noaa.gov)

Refractive Turbulence Study (RTS)

Work continues on data processing for this year's field campaign that was conducted in Australia. The data are being reduced with the final product written to CD-ROM. Of primary interest to the sponsor are values of C_T^2 and C_n^2, these values are retrieved directly from Fourier Spectrum T'. Also of interest is the strength and isotropicity of the turbulence and thus we are investigating spectra of U', V', W' and co-spectra of these quantities. (Jeff.French@noaa.gov)

ET Probe

The latest ET probe built at FRD is basically ready to be used for testing. The software used with

the probe is still undergoing revisions at ATDD, so we were unable to run field tests with the probe in October. Even if the software had been ready, winds were unusually light in Idaho during the month, which would have made it difficult to do anything but road tests with the probe mounted on a truck. During the upcoming months, the plan is to look into methods to flush water out of the probe's ports. The current probes do not have a capability to flush water from the ports, which causes significant problems when it rains. (Richard.Eckman@noaa.gov, Tom Strong, Ron Dobosy and Dave Auble [ATDD])

IMS Development Project

Things went slowly this month on IMS testing. Outside air is now being used. Circuit boards for the DOS stamp were designed and ordered. Noise is an ongoing concern; new shielding will be implemented. Varying the gate pulse width tests were began but not finished in October. (Shane.Beard@noaa.inel.gov, Roger Carter, Debbie Lacroix)

Cooperative Research with INEEL

Emergency Operations Center (EOC)

Jerry Crescenti and Brad Reese attended the annual DOE Emergency Operations Center (EOC) requalification training on October 15, 2002. Kirk Clawson and Jeff French attended the same training on October 22, 2002.

Modifications were made to INEELVIZ to enhance capabilities for Emergency Operations Center (EOC) usage. Viz was modified to handle release durations greater than 24 hours, particularly for reactor releases at the Test Reactor Area. Limiting contour values were added to provide Iodine-131 ingestion dose calculations for several default release scenarios. Changes were also made to display MDIFF dispersion model output through the EOC Website for improved information sharing between the EOC and site Emergency Control Centers (ECCs). Finishing touches are being made to a web based version of INEELVIZ. (Brad.Reese@noaa.gov)

INEEL Support

FRD was invited to participate as a player in the regional emergency exercise known as "Silent Thunder." The exercise was sponsored by the U.S. Dept. of Energy and the FBI with over 100 participants/observers in attendance. Other players included representatives from the two agencies listed above, plus representatives from the State of Idaho Bureau of Disaster Services and INEEL Oversight, the city of Idaho Falls (mayoral, police, and fire department representatives), the INEEL Maintenance and Operations contractor, and the Idaho State Police. Mayors, police chiefs, fire department chiefs, and county BDS personnel from many of the cities and counties in Eastern Idaho were also present. The scenario was designed to test the coordination of the various agencies in the event of a terrorist attack on a nuclear facility such as the INEEL. More specifically, it tested the handoff of emergency response responsibilities in the case of a terrorist threat to a nuclear facility from the DOE to the FBI. (Kirk.Clawson@noaa.gov and Rick Eckman)

A briefing of the DOE Contracting Officer's Representative (COR) on the 4th Quarter Progress Report was conducted on October 28th. The INEEL set a new maximum temperature record in July with 5 continuous days above 100 F. A new all-time temperature maximum was set also in July at 105 F. Data recoveries from the INEEL Mesonet also set a new high, with the average at 99.999%. The COR reported that although FRD requested increased funding to support the DOE this year, we received yet another year of flat funding. With the Continuing Resolution in place, the DOE will only provide funds through February of 2003. (Kirk.Clawson@noaa.gov)

Various meetings were held in October with personnel from INEEL and the State of Idaho INEEL Oversight Program to discuss upgrades to the current INEEL dispersion model. A list of 12 recommendations was put together and presented to DOE management. Some of the recommendations are related to improvements in transport and diffusion modeling, whereas others are related to radiological estimates. The DOE management was generally receptive to the recommendations, although there was concern over the costs of implementation. They asked to be provided with some upgrade options, with budget estimates for each option. These will be put together in November. The current thinking at FRD is that the only viable options will be either minor changes to the current MDIFF model or a full replacement of MDIFF with an alternative model. The first option has little appeal, since it would address only a small fraction of the recommended improvements. ARL has dispersion models available that could be used in the second option. (Richard.Eckman@noaa.gov)

INEEL Mesoscale Modeling

In October a patch was downloaded for the Intel FORTRAN compiler used for the MM5 model. This patch fixed many of the problems that were encountered earlier in compiling the MM5 source code. It also seems to have greatly improved the performance of the model on the new dual-processor Xeon computer at FRD. Some additional tests will be performed in November, but it now looks like the Xeon computer will soon be replacing the Alpha workstation for running the operational MM5 forecasts at FRD. The Alpha will still be used as a test bed for alternate configurations of MM5. (Richard.Eckman@noaa.gov)

Other Activities

AMS Short Course

Jerry Crescenti will be one of several instructors for the American Meteorological Society (AMS) *Short Course on the Fundamentals of Boundary Layer Wind and Turbulence Profiling using Radar and Acoustic Techniques*. This two-day course is sponsored by the AMS Measurements Committee and will be held on February 8-9, 2003 in Long Beach, California, in conjunction with the 83rd AMS Annual Meeting and the Twelfth Symposium on Meteorological Observations and Instrumentation. Crescenti will provide instruction on sodar siting considerations, interference sources (i.e., ambient noise), installation, and maintenance. The slide show can be found at http://www.noaa.inel.gov/docs/sodar.pps.
(Jerry.Crescenti@noaa.gov)

NRC Postdoc Renewal

The National Research Council (NRC) postdoctoral associate position has been renewed for a second year for Dr. Tami Grimmett who is currently working with Jerry Crescenti on air-sea interaction research based on the CBLAST-Low data set acquired by the LongEZ in July/August 2001.

Airborne Weather Research Budget Initiative

The ARL Airborne Research Requirements Workshop was held October 8-9, 2002 in Silver Spring. One of the action items that resulted from the discussions was the development of a budget initiative for submission to the 2005 NOAA budget formulation process. The initiative will request NOAA base funding for developing an airborne weather research program. An ARL inter-division team is developing the initiative based on the research priorities of the U.S. Weather Research Program (USWRP).

The U.S. Weather Research Program (USWRP) is an interagency partnership between NOAA, NASA, National Science Foundation, U.S. Navy, the Academic community, and private enterprise. The goal of the program is to "...accelerate improvements in the national capacity to forecast high-impact and routinely disruptive weather and ...facilitate full utilization of improved weather information." The USWRP has 3 priority research topics: 1) heavy precipitation and flooding, 2) landfalling hurricanes, and 3) societal and economic impacts.

The purpose of the ARL initiative is to secure resources to develop an airborne weather research program in support of the heavy precipitation and flooding research focus. The funding will be used to:

- develop a permanent, interdisciplinary, multi-line office scientific team;
- develop an airborne capability to measure critical land-atmosphere-biosphere interactions;
- develop techniques and algorithms that can be applied to similar measurements from satellites; and
- establish a mechanism to incorporate research results into operational tools.

(Tom.Watson@noaa.gov; Rick Eckman, FRD; Ron Dobosy, ATDD)

Outreach

Shane Beard was invited to give a presentation on cloud formation for the 5th grade at Templeview Elementary School on October 23. A barometer and a psychrometer were used to measure the barometric pressure and the relative humidity. Class members assisted with the measurements. Cloud types and names were discussed; these were familiar to the students as they had been studying clouds. The creation of a cloud in a jar was impressive and caused a lot of "ahhhs". The presentation lasted 45 minutes, and 24 students and their teacher participated. The presentation was a big hit with the students, and they requested a tour of the FRD laboratory as a followup. Arrangements for a November tour were made.

Papers

The manuscript entitled "A Statistical Investigation of Atmospheric Dispersion at the Idaho National Engineering and Environmental Laboratory" has completed the ARL review process. Useful comments were also received from Kirk Clawson and Jerry Sagendorf. The revised manuscript will be published as a NOAA Technical Memorandum. (Richard.Eckman@noaa.gov)

Travel

Kirk Clawson, Jerry Crescenti, Rick Eckman, Jeff French, and Tom Watson traveled to Silver Spring, Maryland to attend and participate in the ARL Airborne Research Requirements Workshop that was held October 8-9, 2002.

Kirk Clawson and Jerry Crescenti traveled to Oklahoma City, Oklahoma on October 29-31, 2002 to attend a Joint URBAN 2003 scientific planning meeting and to locate potential monitoring sites for Doppler sodars.

Randy Johnson and Shane Beard traveled to Mazatlan, Mexico, October 24-28, to launch a hurricane balloon into hurricane Kenna.